

CLAIMS

1. Effect pigments having an aluminum core or aluminum alloy core and an aluminum oxide-containing or aluminum oxide/hydroxide-containing layer enveloping said aluminum core or
5 aluminum alloy core, obtained by chemical wet-process oxidation of lamellar aluminum pigments or aluminum alloy pigments, the content of metallic aluminum in the aluminum core or aluminum alloy core being not more than 90 % by weight, based on the total weight of the pigment, characterized in that
the oxidized aluminum pigments or aluminum alloy pigments exhibit at least one highly refractive
10 metal chalcogenide layer having a refractive index of > 1.95 , and a mixed layer is formed between the highly refractive metal chalcogenide layer and the enveloping aluminum oxide-containing or aluminum oxide/hydroxide-containing layer.
2. The effect pigments according to claim 1,
15 characterized in that
the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the highly refractive metal chalcogenide layer having a refractive index of > 1.95 penetrate each other at least partially.
3. The effect pigment according to claim 1 or claim 2,
20 characterized in that
the thickness of the mixed layer between the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the highly refractive metal chalcogenide layer having a refractive index of > 1.95 is at least 10 nm.
4. The effect pigments according to any one of claims 1 to 3,
25 characterized in that
the refractive index of the mixed layer between the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the highly refractive metal chalcogenide layer exhibits a
30 gradient perpendicularly to the pigment surface extending from the refractive index of the pure aluminum oxide/hydroxide-containing layer and the refractive index of the highly refractive metal chalcogenide layer.
5. The effect pigments according to claim 1,
35 characterized in that
between the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the highly refractive metal chalcogenide layer there is disposed at least one oxide layer of a material having a refractive index of < 1.8 .
6. The effect pigments according to claim 5,

characterized in that

the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the oxide layer of a material having a refractive index of $<1,8$ penetrate each other at least partially.

5 7. The effect pigments according to claim 5 or claim 6,

characterized in that

the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer and the oxide layer of a material having a refractive index of $<1,8$ together form a mixed layer having a thickness of preferably at least 10 nm.

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8. The effect pigments according to any one of claims 5 to 7,

characterized in that

the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer, the oxide layer of a material having a refractive index of $<1,8$ and the highly refractive metal chalcogenide layer

15 having a refractive index of $>1,95$ together form a common mixed layer preferably having a thickness of at least 10 nm.

9. The effect pigments according to any one of claims 5 to 8,

characterized in that

20 the refractive index of the mixed layer between the pure aluminum oxide-containing or aluminum oxide/hydroxide-containing layer, the oxide layer of a material having a refractive index of $<1,8$ and the highly refractive metal chalcogenide layer shows a gradient perpendicularly to the pigment surface, which gradient extends from the refractive index of the aluminum
oxid/hydroxide-containing layer to that of the pure highly refractive metal chalcogenide layer.

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10. The effect pigments according to any one of claims 5 to 9,

characterized in that

the oxide layer of a material having a refractive index of $<1,8$ is a silicon dioxide-containing layer.

30 11. The effect pigments according to any one of the previous claims,

characterized in that

the aluminum core exhibits an average layer thickness of less than 250 nm.

12. The effect pigments according to any one of the previous claims,

35 characterized in that

the aluminum core exhibits an average layer thickness of less than 150 nm.

13. The effect pigments according to any one of the previous claims,

characterized in that

the at least one highly refractive metal chalcogenide layer having a refractive index of > 1.95 comprises a colored metal chalcogenide layer or a plurality of colored metal chalcogenide layers.

14. The effect pigments according to any one of claims 1 to 12,

5 characterized in that

the at least one metal chalcogenide layer or a plurality of metal chalcogenide layers having a refractive index of > 1.95 comprises a metal chalcogenide layer or a plurality of metal chalcogenide layers having substantially no intrinsic color.

15. The effect pigments according to any one of claims 1 to 12,

characterized in that

the at least one metal chalcogenide layer or a plurality of metal chalcogenide layers having a refractive index of > 1.95 comprises colored metal chalcogenide layers and metal chalcogenide layers with substantially no intrinsic coloration and are arranged in a predominantly alternating configuration.

16. The effect pigments according to claim 13 or claim 15,

characterized in that

the colored metal chalcogenide layer or a plurality of colored metal chalcogenide layers is selected from the group consisting of preferably iron oxide, vanadium oxide, tungsten oxide, chromium oxide and the hydrated oxides thereof, and mixtures thereof.

17. The effect pigments according to claim 16,

characterized in that

the iron oxide is present in the modification hematite, goethite, magnetite or mixtures thereof.

18. The effect pigments according to claim 14 or claim 15,

characterized in that

the sole metal chalcogenide layer or the a plurality of metal chalcogenide layers with substantially no intrinsic coloration are selected from the group consisting of titanium oxide, zirconium oxide, zinc oxide, tin oxide, cerium oxide and hydrated oxides thereof and also mixtures thereof.

19. The effect pigments according to any one of claims 5 to 13,

characterized in that

there is applied to the aluminum oxide-containing or aluminum oxide/hydroxide-containing layer a silicon dioxide layer followed by an iron oxide layer.

20. The effect pigments according to any one of the previous claims,

characterized in that

there is applied to the at least one metal chalcogenide layer having a refractive index of > 1.95 at least one oxide layer having a refractive index of < 1.8 .

21. The effect pigments according to claim 20,

5 characterized in that

the at least one oxide layer having a refractive index of < 1.8 is selected from the group consisting of silicon dioxide, aluminum oxide and/or aluminum hydroxide, boron oxide, and mixtures thereof.

22. The effect pigments according to any one of the previous claims,

characterized in that

they possess a form factor of more than 20 and preferably more than 25.

23. The effect pigments according to any one of the previous claims,

characterized in that

they possess a form factor of more than 40.

24. The effect pigments according to any one of the previous claims,

characterized in that

the aluminum pigments or aluminum alloy pigments are surface-modified with organic groups or organic compounds.

25. The effect pigments according to any one of the previous claims,

characterized in that

the aluminum pigments or aluminum alloy pigments have a colored appearance showing a soft color flop.

26. The effect pigments according to any one of the previous claims,

characterized in that

the metal chalcogenides are metal oxides, metal sulphides, metal selenides, metal tellurides, or mixtures thereof.

27. The effect pigments according to any one of the previous claims,

characterized in that

the aluminum alloy contains at least 5 % by weight, based on the metal content of the pigment, of one or more of aluminum and various metals, preferably iron, manganese, copper, vanadium, chromium, nickel, cobalt, silicon, magnesium, zinc, and/or titanium.

28. A process for the production of effect pigments according to any one of claims 1 to 27,

characterized by

(a) oxidizing aluminum pigments or aluminum alloy pigments which are suspended in a liquid phase containing organic solvent, using an oxidizing agent,
 (b) applying at least one metal chalcogenide layer having a refractive index of > 1.95 onto the pigments oxidized in step (a), during which process a mixed layer forms between the metal
 5 chalcogenide layer and the aluminum oxide/hydroxide layer.

29. The process according to claim 28,
 characterized in that
 an oxide layer having a refractive index of < 1.8 is applied prior to the application of the at least
 10 one highly refractive metal chalcogenide layer having a refractive index of > 1.95 in step (b).

30. The process according to claim 28 or claim 29,
 characterized in that
 the oxidizing agent in step (a) is water and the organic solvent is water-miscible.

31. The process according to claim 30,
 characterized in that
 the amount of water based on the aluminum pigments or aluminum alloy pigments is from 10 to
 120 % by weight, and preferably from 15 to 55 % by weight.

32. The process according to any one of claims 28 to 30,
 characterized in that
 a catalyst is added in step (a).

33. The process according to any one of claims 28 to 32,
 characterized in that
 in step (b) the application of the metal chalcogenide layer is carried out by the addition of metal
 salt dissolved in substantially organic solvent to a dispersion of aluminum pigments or aluminum
 alloy pigments oxidized in step (a).

34. The process according to any one of claims 28 to 33,
 characterized in that
 the organic solvent is selected from the group consisting of alcohols, glycols and ketones and
 preferably ethanol, *n*-propanol, isopropanol, *n*-butanol, isobutanol, *tert*-butanol, methoxypropanol,
 35 acetone, butyl glycol, and mixtures thereof.

35. The process according to any one of claims 28 to 34,
 characterized in that
 the oxidation in step (a) is carried out at a temperature between room temperature and the boiling
 40 point of the mixture of water and organic solvent.

36. The process according to any one of claims 28 to 35,
characterized in that
in step (a) the suspension exhibits a pH between pH 7 and pH 12.

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37. The use of the effect pigments according to any one of claims 1 to 27 in coatings,
varnishes, motor vehicle enamels, powder-based varnishes, printing inks, writing inks, plastics
materials, glass, ceramics, or cosmetic preparations.

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38. The use according to claim 37,
characterized in that
the cosmetic preparations are selected from the group consisting of nail varnish, lipstick, make-
up, hair treatment preparations, skin care preparations, mascara, eye-shadow, eyeliner, rouge,
perfume, eau de toilette, powders (in bulk or compressed), and tattooing formulations.

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39. A coating composition,
characterized in that
it contains effect pigments according to any one of claims 1 to 27.

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40. The coating composition according to claim 39,
characterized in that
it is selected from the group consisting of coatings, varnishes, motor vehicle enamels, printing
inks, writing inks, plastics materials, glass, ceramics, or cosmetic preparations.

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41. The coating composition according to claim 41,
characterized in that
the cosmetic preparation is a nail varnish.

Summary

The invention relates to effect pigments having an aluminum core or aluminum alloy core and an aluminum oxide-containing or aluminum oxide/hydroxide-containing layer enveloping said
5 aluminum core or aluminum alloy core, obtained by chemical wet-process oxidation of lamellar aluminum pigments or aluminum alloy pigments, the content of metallic aluminum in the aluminum core or aluminum alloy core being not more than 90 % by weight, based on the total weight of the pigment, wherein the oxidized aluminum pigments or aluminum alloy pigments exhibit at least one highly refractive metal chalcogenide layer having a refractive index of > 1.95 ,
10 and a mixed layer is formed between the highly refractive metal chalcogenide layer and the enveloping aluminum oxide-containing or aluminum oxide/hydroxide-containing layer. The invention further relates to a process for the production of such effect pigments and to the use thereof.